

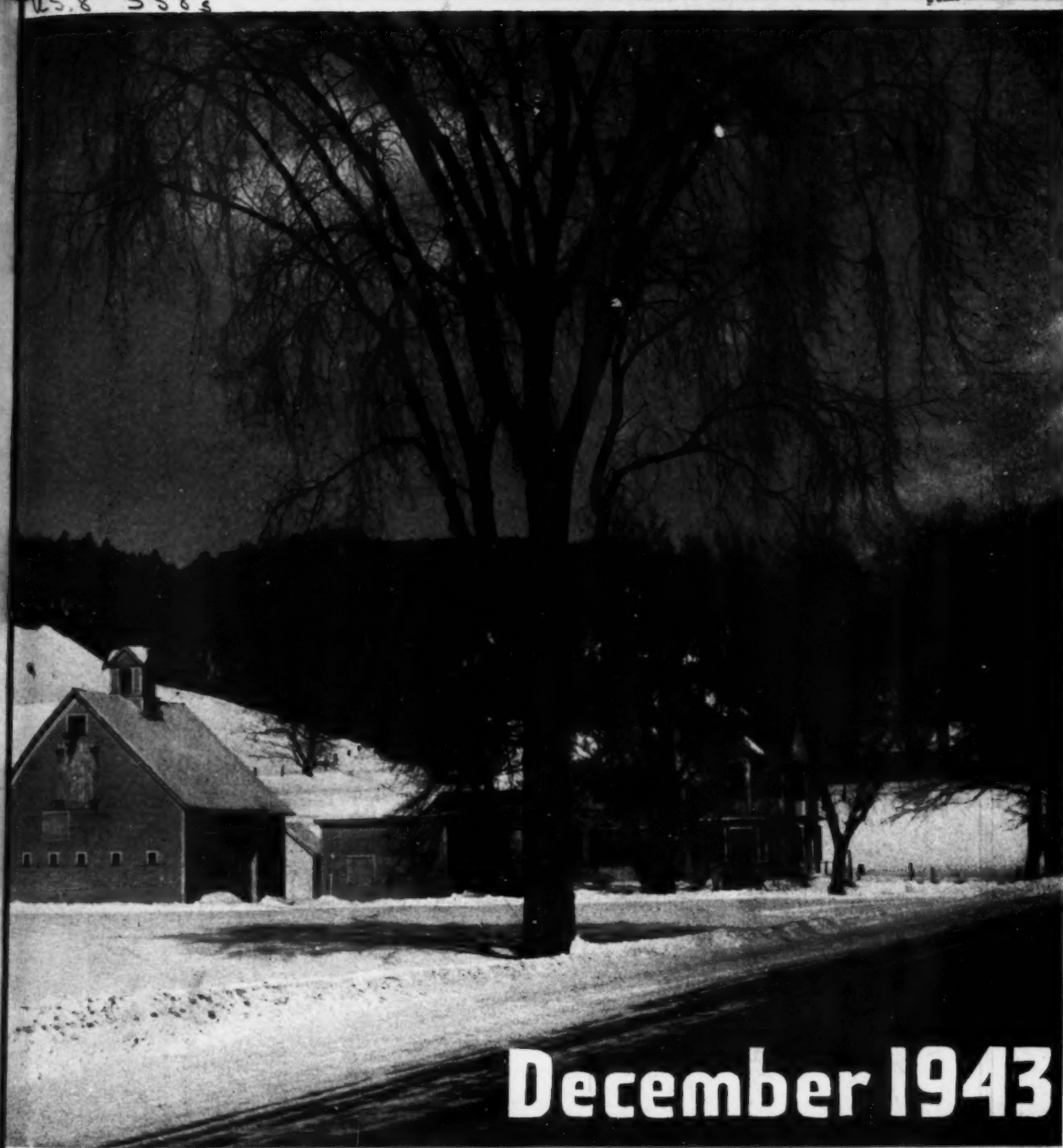
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December 1943

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

CONTENTS

| | Page |
|---|------|
| SOIL CONSERVATIONISTS AT WAR: | |
| By William R. Van Dersal and Verna C. Mohagen..... | 123 |
| TODAY'S BOND PURCHASES ASSURE TOMORROW'S TRACTORS: | |
| By Wellington Brink..... | 126 |
| CHINA'S FARMS FIGHT: | |
| By Walter C. Lowdermilk..... | 128 |
| MANAGING THE WATER FROM THE "ROOF TOP" OF THE NATION: | |
| By C. J. Francis..... | 135 |
| STUBBLE MULCH IN THE SOUTHERN PIEMONT: | |
| By B. H. Hendrickson, John R. Carreker, William E. Adams..... | 138 |
| FOR REFERENCE: | |
| Compiled by Etta G. Rogers..... | 143 |

WELLINGTON BRINK
EDITOR

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SOIL CONSERVATIONISTS



BY WILLIAM R. VAN DERSAL AND VERA C. MOHAGEN

Six years before the Nazis marched on Poland and 8 years before Japan struck at Pearl Harbor, a handful of people began a long-time battle to save American land from despoliation. That handful grew in size and went through the spasms of development characteristic of any growing organization, but it emerged with one clear and steadfast idea—that American land was worth fighting for.

In the months immediately following Pearl Harbor, the handful that had grown finally to be the Soil Conservation Service undertook to fight for America in a new way. By every means at its command and with the willing help of hundreds of thousands of farmers, it reshaped its program of action in such a way as to accomplish the greatest possible production of food needed for war. To the armed forces of the Nation it gave a full fifth of its manpower, and to other agencies set up to carry on emergency programs of the war, it loaned nearly a fourth of its experienced people.

Today some 15,000 soil conservationists wage war on the enemies of their country. More than 9,000 trained conservationists are at work assisting farmers to produce agricultural products vital to the conduct of the war; nearly 2,700 conservationists—men and women—fight with the Army and Navy on battlefronts around the globe; and 3,000 other conservationists labor in a dozen agencies producing rubber, increasing food production in foreign countries, carrying on lend-lease activities, distributing food, mapping strategic areas, and performing a hundred other tasks that go to make up the waging of total war. But however and wherever soil conservationists serve their country, each one still has steadfastly in mind the idea that American land is worth fighting for. The conservationists in uniform or in other war agencies have not been lost from the Service. On the contrary, here is a sharing of manpower, technical ability, and administrative experience in a period of great national emergency, and a spreading of conservationists all over the world.

EDITOR'S NOTE.—The authors are chief and assistant chief, respectively, of the personnel management division, Soil Conservation Service, Washington, D. C.

The Service takes no chance on losing touch with its members—women and men—on the war front. From every region and from Washington there go out at periodic intervals personal letters and mimeographed circulars to each conservationist in uniform, telling of what goes on at home. These bits are received and read in the foggy Aleutians, in the wilderness of the Alaska Highway, in the jungle outposts of India and China, in the shade of palms on the islands of the Pacific, in the desert wastes of Africa, and in the camps of England, Sicily, and the United States.

Return letters bespeak glowing appreciation of the news from home, and show, too, that military exploits have not changed the concern of conservationists for proper use of land.

"I wish every American could see the lessons of India and China as to soil erosion. Proud, mighty, and ancient people reduced through loss of resources (soil primarily) to military impotency and economic poverty beyond the average American's comprehension * * *"—so writes Capt. Ralph Wilcox, formerly assistant regional forester at Milwaukee, now with a bomber squadron.

From Lt. R. J. Nesbit, formerly camp superintendent, now in North Africa: "Erosion is severe along the entire coast. Contouring and terracing would be easy. * * * I believe we could easily swing into a soil conservation program with the natives after the war. If the vineyards were on the contour, it would help considerably."

From Hawaii Capt. S. E. Bowman (former district conservationist) writes that "Not long ago I saw a pasture of several thousand acres made up almost entirely of familiar grasses, that was * * * on the slope of a historic volcano and miles long without a trace of erosion. The slope was 15-20 percent and in an area of high rainfall."

And in England—"So far I haven't seen any gullies or any wasted land * * *" says Lt. J. McKee, former conservation aid.

Hundreds of letters reach the Service from its men in the forces every month. And that they are still part of the Soil Conservation Service these men well know. By this time 196 have been given grade promotions *in absentia*. Consideration is given to every conservationist in the armed forces for promotion in civilian ranks whenever Service positions develop for which they are qualified. Official notifications sent them on the front contain a brief description of their new job, so that between knocking out Japs or pushing Nazis out of Italy they can be turning over in their minds the big job in store for them when they come marching home again.

Every man and woman in the armed forces knows that jobs are waiting for them at the war's conclusion. There is triple assurance of that. Not only has the President announced it as a national policy and Congress passed a law about it, but the Chief of the Soil Conservation Service, expressing the will of the 9,000 conservationists at home, has given his personal assurance as well.

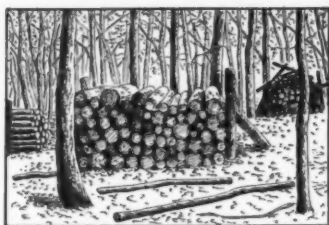
Back home inevitable changes in the home front organization have meant that many jobs have automatically become obsolete. Some of these were occu-

Soil Conservation Service Employees on Military Furlough

| | |
|---------------------------------------|-------|
| Washington..... | 72 |
| Beltsville..... | 93 |
| Northeastern Region (1)..... | 149 |
| Southeastern Region (2)..... | 667 |
| Upper Mississippi Region (3)..... | 308 |
| Western Gulf Region (4)..... | 582 |
| Northern Great Plains Region (5)..... | 294 |
| Southwestern Region (6)..... | 247 |
| Pacific Region (7)..... | 218 |
| Total | 2,630 |

Conservationists Who Have Died in Their Country's Service Since Pearl Harbor

| Former headquarters | |
|-----------------------|--------------------------|
| Clifford Wayland.... | Washington, D. C. |
| Nance D. Stark..... | Southeastern Region (2). |
| Noel A. Brown..... | Western Gulf Region (4). |
| Chester L. Buoy, Jr.. | Do. |
| George A. Lunt..... | Southwestern Region (6). |
| J. Ray McCorkle.... | Do. |
| James D. Mobley.... | Do. |
| John A. Simons..... | Do. |
| Loren E. Thompson.. | Do. |
| Otto E. Kneuer..... | Pacific Region (7). |



pied by men now in the armed forces. To make the Chief's assurance good without delay, action has long since been under way to place employees furloughed from nonexistent jobs in permanent positions elsewhere in the Service. This is done also *in absentia*, of course, and the jobs are actually filled for the duration by war service employees. Going still further—a few of the conservationists in uniform themselves held war service appointments. And while there exists no legal protection for these men, the Service expects to do everything it can to find a place for them in soil conservation work after the war.

That there is cooperation in the war job is well attested by the work of one lieutenant, formerly in the Service, who directs technically trained men honorably discharged from the Army for physical disabilities to the nearest Soil Conservation Service office for employment.

At home in the meantime, soil conservationists work longer and harder at the job of coaxing production from the American land that the men and women in all Allied uniforms may be well provided for. The job is not easy. There are no medals, no uniforms, but every day, all day long, they pursue the work of increasing food production on the land to the utmost limits of its capacity to produce.

There has been little time to check results closely. The increases in production average 20 percent or more throughout the country as a whole. This the

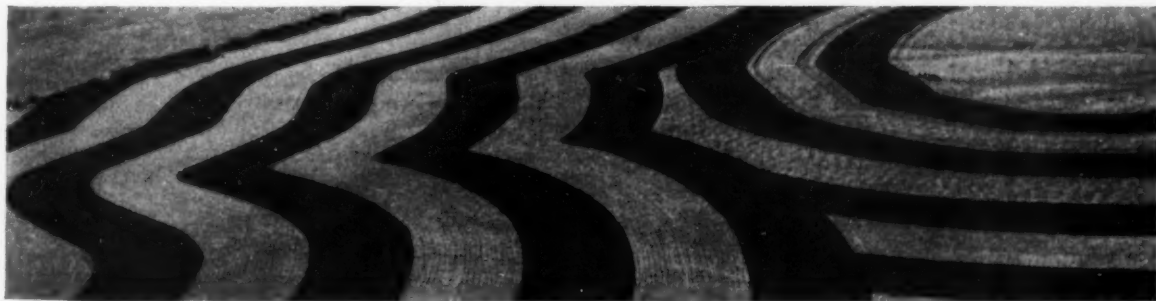
home front conservationists know from controlled research work no less than from the thousands of enthusiastic reports of conservation-minded farmers. This crop year, estimated with the rigid conservation of the research specialist, as many as 206 liberty ships of 10,000 tons capacity each could have been filled with the extra food and fiber and oil that came from American land handled under conservation methods. *Extra* products that could not have been grown under old methods. And next year, more.

While conservationists have been at war, soil conservation districts have continued to form as rapidly as ever. Today 935 districts, including a full third of American cropland, have been organized and 137 more are in process of formation. And in every district, farmers and conservationists move forward together in the biggest job they've had since the fight to save American land began.

Conservationists at home went over the top, early in the game, on the war bond drive. Feeling pretty proud of themselves they were, too, until conservationists in uniform wrote to tell of some of them buying bonds with every last dime of their slim pay checks. Or of the battalion in the Pacific that had bought \$18,000 worth of bonds by last June, "which is pretty good," according to a fighting conservationist, "considering 90 percent of them have families to support."

But the home front conservationists know that there has never been a time when the Service could render to the Nation a service so great, or so necessary, or so valuable, as it is now doing. Every conservation practice applied now to increase agricultural production means, of course, a saving of soil for future years and a building of security for future generations. There can be no more essential or constructive job than this. And when the time comes that all soil conservationists get together once again, the battle to save American land may be expected to go on to a conclusion as victorious as the war to keep America free.

No chevrons these, but badges of accomplishment on the land.



TODAY'S BOND PURCHASES ASSURE TOMORROW'S TRACTORS

SOIL CONSERVATION DISTRICTS ACQUIRE SIZEABLE PORTFOLIO OF GOVERNMENT SECURITIES

MANY THOUSANDS of dollars have been invested in war bonds by soil conservation districts.

Reports on such investments received by *Soil Conservation* magazine are fragmentary at best, in the absence of a systematic survey, but they are sufficient to indicate the financial support which districts are adding to their production support of the armed forces.

Letters tell the business acumen and patriotic philosophy behind the buying of bonds by districts: (1) Determination to help win the war at home and overseas, to defeat the Axis and lick inflation; (2) hard-headed consideration of safety for surplus funds—prevention of erosion of the district exchequer; (3) the profit motive—thrift idea—cumulative interest that corresponds to “continuing production”; (4) a touch of canny foresight—a look ahead to the time when machinery and other equipment must be replaced, when goods and services not now available will again be obtainable in exchange for ready cash.

A few examples, beginning with New Mexico, where five districts have purchased war bonds—

Mesa Soil Conservation District, Mosquero, N. Mex., has bought a \$1,000 bond with money earned from rental of machinery. At redemption time, the money will be used for purchase of new district machinery. The district may buy a few \$100 bonds in the future.

Roosevelt Soil Conservation District, Portales, N. Mex., has bought sixteen \$25 bonds, using money earned from machinery rental. The district bought its first bond in July 1942, and believes it was one of the first districts in the United States to invest funds in bonds. It plans to buy at least one additional \$25 bond each month in the future and will use bonds to purchase post-war machinery.

Upper Hondo Soil Conservation District, Roswell, N. Mex., \$300 in bonds. Money from equipment rentals. No definite amount for future bond purchases, but the supervisors expect to invest most of their machinery earnings in bonds. It will use bonds to buy district equipment after the war.

Claunch-Pinto Soil Conservation District, Mountainair, N. Mex., three \$25 bonds bought from general funds of district. Future use: “To further soil conservation work.” Future purchases: One \$25 bond each month.

Border Soil Conservation District, Portales, N. Mex., one \$25 bond, from earnings of district equipment. Future purchases: Can't determine because of heavy cost of keeping equipment repaired. Future use of bonds: “To further district program.” Two districts in Colorado have purchased bonds, as follows:

Smoky Hill Soil Conservation District, Burlington, Colo., eight \$100 bonds. Source of money: AAA payments, machinery rental, and sublease of State lands. Future purchases: \$500 during 1944. Future use of bonds: Machinery replacement and purchase.

Southeast Baca Soil Conservation District, Walsh, Colo., has purchased \$1,200 series E bonds and \$3,000 series B bonds from money secured from AAA payments for conservation work. Any additional money obtained in this way will be invested in bonds, and money will be used to purchase district equipment when bonds are redeemed.

Swinging back east across the country, we find the Congaree Soil Conservation District in South Carolina investing \$5,000 in war bonds, planning to follow with \$1,500 additional in the near future. The supervisors plan to cash the bonds after the war to buy needed equipment.

A labor shortage in the Wiregrass Soil Conservation District in Alabama prevented the supervisors from making the most efficient use of their tractor. They knew that the tractor, which was in good operating condition, could be used to speed the construction of war plants. So they sold the tractor for \$1,500, investing \$1,400 of this amount in war





bonds. After the war, they'll turn the bonds into equipment.

The Thomas Jefferson District in Virginia invested \$1,334.90 in war bonds and stamps, and the New River District, also in Virginia, came up valiantly with the purchase of six \$100 bonds. Both these districts contemplate buying equipment suited to their soil conservation programs. Another district in this State, the James River District, bought ten \$100 bonds, holding in abeyance a decision as to what will be done with the money at maturity.

Over in Mississippi the Claiborne County District and the Copiah County District sold heavy equipment that was too worn for economical operation and with the proceeds pocketed war bonds of \$1,800 and \$2,300 maturity values.

Down in Florida series E war bonds with a maturity value of \$2,500 were acquired by the Ochlocknee River District, with the plan to hold them at least for the duration.

Hoosier State trends are in the same direction. The Southwestern Indiana Soil Conservation District, Evansville, started out with the purchase of \$700 worth of bonds, set up a policy of similarly investing all district funds in excess of an operating kitty of \$300. Since adopting this plan the district has added to its list five \$100 bonds which were bought during the Third War Loan Drive.

In West Virginia where most districts are too new to have accumulated financial reserves, the contagion is nevertheless taking effect. The Greenbriar Valley District was among the first to set aside funds for war bond purchases.

The Northern Great Plains Region, noted for always striking fast and hard and continually, is buying bonds with enthusiasm—and dollars well aimed at the main target. These dollars were accumulated from equipment rentals, proceeds from the sale of seed from district seed plots, and in some instances from the operation of grazing permits. The bond-purchasing accomplishments of represent-

ative districts in this area may be summarized as follows:

North Dakota:

| | |
|--|-------|
| Turtle Mountain Soil Conservation District.... | \$250 |
| Cedar Soil Conservation District..... | 2,500 |
| Arnegard-Alexander Soil Conservation District... | 200 |

Nebraska:

| | |
|---|-----|
| Harlan County Soil Conservation District..... | 300 |
| Otoe Soil Conservation District..... | 500 |

Kansas:

| | |
|--|-----|
| Ness County Soil Conservation District..... | 200 |
| Labette County Soil Conservation District..... | 500 |

Montana:

| | |
|---|-------|
| Prairie County State Cooperative Grazing District.. | 3,000 |
| Fallon County Cooperative Grazing District..... | 1,500 |
| East Custer Cooperative State Grazing District... | 1,000 |

Comparatively meager are the reports from the Far West, although there is ample reason for thinking that district participation in the financial support of the war job is evenly spread throughout the country. It is confirmed, however, that the Asotin Soil Conservation District in Washington some months ago lighted the way to victory with \$1,000 worth of greenbacks exchanged for a noble and thrift-significant bond some months ago.

These citations present but part of the story, for district supervisors are busy men with lots of time for the land but little time for the letters. They are sufficient, however, to emphasize the affinity of conservation of the soil, conservation of the people, and conservation of civilization. It is an affinity apparent in the agricultural action program of today. Bond purchases by districts speak well for the foresight, wisdom and downright patriotism of the men and women who farm that the world may eat and survive and roll on to better days.

—Wellington Brink.





CHINA'S FARMS FIGHT

By WALTER C. LOWDERMILK

This is the first of several letters from Dr. Lowdermilk that will be published in "Soil Conservation." The author is Assistant Chief of the Soil Conservation Service, presently engaged in China as agricultural advisor to the Chungking Government. (See Editor's Note in January 1943 issue.)

IN MY WANDERINGS over the earth, China remains the most fascinating country of all. China was great when Babylon was great. It has come down to this present time without the usual rise and fall.

This great land, where a fourth of the human race lives, has faced all of the problems of struggle for food and of conflict with the powerful forces of nature. In some areas, by ingenuity and the labor of countless millions, China has won the battle and provided a region with a permanent food supply. Sometimes erosion and floods have won and the people have failed, despite centuries of effort. I have yet to find a major problem of land use but what some ingenious farmers of the past have worked out satisfactory measures of control, even though on a limited scale. One cannot get away from the fact that the experience of a few thousand years, even this process of trial and error, gives a real head start. Age brings wisdom, even though it is the wisdom that grows out of mistakes of the past. So it is, that the erosion and silt and flood problems of China, after centuries of striving, fairly shout out a warning to us in the United States to establish permanent measures of protection for our lands before it is too late.

During my years in China from 1922 to 1927, this vast western region that is now Free China had not yet been rediscovered. Comparatively little was known about it in the centers of modern progress along the coast. In the United States, the westward trek was gradual, whereas in China the ruthless Japanese invasion plunged 50 million Chinese, many of them intellectuals, into a headlong race for these pioneer regions—the greatest mass migration in all history. Even here the Japs rode the skies unmolested, and dropped their "iron eggs," as the Chinese say.

Free China was not a region of wide open spaces. It has been occupied for more than 4,000 years, and today it has a population approximately the same as that of the entire United States. Only in the tribal lands and borderlands of Tibet are there underpopulated areas. China's West contains vast undeveloped resources of minerals, water for electric power, flowing salt wells, the possibility of becoming almost self-sufficient.

West China is the Switzerland of China, Szechuan Province is considered the Garden Province. It slopes up against the mighty snow mountains of Tibet, whose first range rises abruptly to 6,000 feet, followed by other ranges reaching 16,000 feet. There are peaks of perpetual glaciers towering to 24,000 feet which, on a clear day, I have been able to see from Chengtu, the capital city. Streams and clouds send down an abundance of water from the mountains and the Province takes on the appearance of one sunken garden after another. Villages are like polka dots, toy-like from a plane.

How can I describe the landscape of Szechuan Province? Here every foot has been worked and re-



Two views of one of the areas chosen for a demonstration. It was just sundown and farmers were hastening to finish their sheaves and carry them home, after cutting the harvest by small hand sickles all day.

worked into a phantasmagoria of fields which form intricate and bewitching patterns—some purplish red, prepared for planting; some in standing water retained for the spring planting of rice; some yellow with rapeseed in flower, others green in wheat or broad beans. The patterns of fields disclose little valleys up to their heads, where a perfect upstream system of water control has been worked out. They appear like amphitheaters. So intricate is the design of field terraces that no erosion is possible except on steep slopes of higher ranges. Why have not our poets, artists, economists, engineers, and agriculturists proclaimed the magnitude of these works? Here I have found a fascinating phenomenon of terrace patterns that surpasses that of the Lebanon Mountains in Syria. It represents the achievements of millions of men through centuries. If ever a people were entitled to a land, to hold and to enjoy, it is the Chinese, who have so fully occupied and used the lands of this well-watered region.

Yes, suddenly, with the stampede of a gold rush, came 50 million people on foot, by wheelbarrow, by houseboat, by junk or by any conveyance possible, with only such personal possessions as could be carried on backs or in bundles. Imagine the food problem, the problem of supplying the essential needs of this great pilgrimage which was accomplished in but one brief year or two. There were practically no avenues of transportation to bring in supplies, no industrial machinery to take care of even the former local demands.

It is here, under these circumstances, that the Chinese have held the line for democracy. It is here that they have accounted for more than a million dead Japs and have held down about a million live ones—this in spite of unpreparedness. The Chinese never surrender. They fight to the limit of their equipment and endurance, and fall back to fight



A remarkable mulch of gravel is used on this melon patch. Its purpose is to reduce evaporation in dry northwestern China, and to increase the intake of water. It helps, too, to keep the underlying soil warmer during chilly nights. It is a laborious way to save moisture, for the gravel is hauled from a distance. After 30 years, when it becomes too mixed with soil, it is sifted out and entirely new gravel mulch is put on—about 4 inches deep. The Chinese farmers, who learn many things by experience, say that irrigation with muddy water will quickly ruin such fields.



China's land must support a double population, supply food for the living and provide space for a host of ancestors. The more land occupied by an ancestor, the greater the reverence. When interpreted through its results of expensive funerals and of valuable lands appropriated by the dead, ancestor worship is seen as a heavy yoke. It makes dead men into gods who require space and respect not accorded to the living.

some more. Now, they are fighting with their backs to the literal wall—the Tibetan Mountains.

Free China is a big country, and the Chinese are a big people. They are generous to a fault, slow to anger and quick to forgive. They love freedom, and the Japs have found that they make poor slaves. For freedom they fight furiously.

On top of more than 5 million killed, more than a third civilians, and an estimated 2 million orphans and billions of dollars in property losses, China has been saddled with a byproduct of war which is almost as bad. The inflation in China today is staggering. Once we could exchange our gold dollars for Chinese money and live far better than we could on the same amount in the United States. Now all that has been reversed. The Chinese could exchange their money, come to our country, and live far better than they could under inflation in Free China.

There is no rationing. Anyone can buy anything there is to buy if he has the cash. Stores are open, but stocks are very low. A bottle of ink costing 10 cents at home costs \$2 in United States or \$40 in Chinese money. A friend of mine sold a shirt which has been laundered twice, for \$25 in our money. A second-hand pair of shoes, well repaired, sold for \$65 United States money or \$1,300 Chinese. A jacket which could be bought in America for \$12 was sold for \$85 United States or \$1,700 Chinese. A bar of soap costs 50 cents in United States money, a needle 50 cents, a razor blade \$1.

Paper is scarce and hard to get. I paid \$15 Chinese money or about 75 cents United States for three pieces of red paper and five small pieces of string to wrap up a gift. Gasoline is \$12.50 to \$15 per gallon in United States money, except in the north where a poor grade of oil is produced. In lieu of this, alcohol, wood, charcoal or even sometimes camphor is used to run autos and trucks. A suit of clothes sells for \$400 to \$500 in United States money or \$8,000 to \$10,000 in Chinese money. A missionary sold a bicycle he had used for 10 years for \$600 United States money.

Food, under inflation, even when locally grown, is beyond reach of those who do not have the cash. Previous to the war, one bought 60 eggs for \$1. Now, under inflation, one egg costs \$1.80 Chinese money—an increase of 108 times, or 10,000 percent. Rice prices have increased even more. I paid \$3, United States money, for a small bag of oranges right where they were grown. After traveling in the spring, with no fruit, I saw some early grapes, not quite ripe, but three small bunches cost me \$1.50 United States money. My great thrill, after going without fruit for weeks on a country trip, came when I stopped at a mission station, found within the com-

pound wall an apricot tree full of tree-ripened fruit and was told to eat all I could. Only twice during this 5 months' trip did I have a cup of coffee, and that was with missionaries who had brought it out from furlough and kept it for special occasions. I would not like to say how many times my mouth has watered for a breakfast of fruit, bacon, eggs, toast, and jelly, as week after week, my breakfast consisted of noodles, pickled and salted vegetables, and perhaps an egg and tea. In the extreme northwest region, no rice is grown and the "staff of life" is cereal products. How I have missed having a bit of sugar in my diet! But we have with us vitamin tablets and do not really suffer for body-building foods, but the poor Chinese, especially those of the white-collar class and students, are many times emaciated for lack of proper food. They cannot live on their salaries. Banks and Government departments often augment salaries with an allotment of rice. One of my former students, a Ph. D. engineer, told me that he and his wife actually were relieved when their 20-month-old son died, because they did not see how they could possibly raise him. This, from a Chinese steeped in ancestor worship and the desire for sons, shows the devastating influence of inflation.

But with all the hardships of inflation and of years of continual bombing, the most remarkable thing to me is the energy and go-ahead urge of this people. Everyone is busy, even to the children. Everyone wants to do something for China. Even in the remote areas, peasants are building roads and carrying military loads. When the Japs invaded, they seized or destroyed about 90 percent of China's industry. Before their arrival, Chinese workmen loaded tools and machine parts on their backs and transported enough of them to the interior to keep up a supply of small arms and certain necessary war materials, sufficient to hold off the Japs.

One of the phenomena of our times is the development of the Chinese industrial cooperatives. Thousands of young men are being trained to organize and supervise cooperative units. They are working out machinery simple enough to be made locally, and yet give efficient and adequate output. They have improved the Ghandi spinning wheel and put improvements onto the early American type and on former Chinese spinning methods. Cooperatives are placed in proximity to raw materials so that only finished articles need transportation. They are placed in homes, in temples, in caves, and in country villages. Many essential ones are close to the Japanese lines in the guerilla areas. When the Japs advance, the Chinese workers are warned by the guerillas. They put the machinery on their backs and make off with it into the hills until danger is past. Individuals could

sell machinery or parts at tremendous profits, but it is never done. The cooperatives supply millions of dollars' worth of essential needs monthly and are training tens of thousands of Chinese in industry, yet they are decentralized and not exploitive. Here is a demonstration of how China may be able to go through her industrial revolution without all the suffering and problems which were experienced in western nations. There are many regions of subsistence farming on steep slopes and erosion-devastated areas, where there must be a difficult period when people are not free to till the soil but must bring it back to forests or managed grazing. It appears that these industrial cooperatives may, at least in part, bridge over the transition period.

The Chinese are in many ways like us, they do a lot of laughing and singing. They laugh at and enjoy the same things we do. Their great sense of humor helps keep up their morale. They believe in individuality and in the dignity of man. They are the most adaptable people on earth. They have an expression, "giang jew", which means "make the best of the situation" or "adapt yourself" and in this the Chinese have revealed themselves as the world's experts.

One of the most fascinating and gripping stories of this war period is how 642 students and professors of the University of Nanking, where I spent my first 5 years in China helping in the departments of Forestry and Agriculture, fled from Nanking to Free China. They took hundreds of boxes of University equipment and books and limited themselves to what personal baggage could be carried. Just an hour after they left the dock, Jap planes came over and sank two ships. Twenty minutes after their boat left Ichang to go up through the Yangtse gorges, the Jap planes sank several ships which had been docked beside them. Then came the tedious trials of transshipping all this university and personal baggage from Chungking to Chengtu, 250 miles further inland. Yet not one box or trunk was lost, and the only damage was mildew on some books which had gotten wet on a junk that struck a rock in the rapids of the Yangtse gorges. Only a few test tubes were broken.

With great difficulty the School of Agriculture had procured some fine strain milk cows from other countries. If left in Nanking, the Japs would have confiscated them, so the cows also started off on the long trek to Free China, accompanied by attendants. It took months, but in time the cows arrived, and I have pictures of them contentedly mowing the grass on the university campus in Chengtu, apparently none the worse for their 1,500-mile walk and a little hitchhiking on small boats.

It is thrilling to see the way the Chinese, with years of training abroad, are facing the lack of almost everything deemed necessary—and making good. Here in Chengtu, the capitol of Szechuan Province, are about 33 universities and colleges. Most of faculties and students literally put their books and equipment on their backs and laboriously trekked from the coastal cities to Free China. They are carrying on with the largest enrollments in history.

I saw a pile of boxes, and Dean Fen of the Central Chinese University of Nanking told me that they had packed and hauled 10,000 such boxes from Nanking to Chungking. During the clear weather they moved their laboratories into the country temples to carry on in spite of Japanese bombing. A soils man apologized for the cramped surroundings, but not for the work.

This is the spirit of the New China. We of the west may well look to our laurels when this great people really gets going. It is to our advantage to keep China as our friend. Dr. H. H. Kung expressed his pleasure at our willingness to come to the assistance of China in scientific and technical matters, and assured us of his help in whatever we should desire. The Chinese have received me as an old friend, or as a member of the family, with such cordiality that it is sometimes touching. My former students are in active work in agriculture, forestry or flood control, and have been eager to show me the results of their efforts.

One of my former students has charge of a large area assigned to the rehabilitation of wounded or crippled soldiers and to demobilized soldiers. Industries here are not well enough developed to absorb more than a small fraction of the soldiers who will be disbanded at the close of the war. It is on the newly opened up and underpopulated areas in the border lands that we have the best opportunity of starting the application of proper measures for protection of the lands and waters of the region. Here I feel is one of our greatest opportunities to set up effective demonstration areas. In other long occupied areas custom makes it much more difficult to persuade farmers to change from the old ways of land use. I have been called upon to direct the land-use program of many of these newly opened areas. In spite of the present burden of war, China is making definite plans for the future and putting them into effect as rapidly as possible.

I was here for the New Year which coincided with the celebration of the thirtieth anniversary of the founding of the University of Nanking College of Agriculture and Forestry, and for the coincident celebration of the signing the latest treaties between China, Britain, and the United States.

Tireless work has been spent in preparing the Nanking College of Agriculture exhibits. One exhibit dealt with the Peshien area, on which are found the natural features to work out a small T. V. A. project. Erosion is serious on the slopes of mountains that extend in peaks to 10,000 feet, where corn is grown year after year. Following my suggestion, two run-off boxes were prepared to demonstrate with sprinkling to resemble rain, the effect of forest littler in preventing erosion, and the serious erosion that is caused by rain on bare soil on a slope. There were also two model farms showing the contrasts between nonconservation and conservation farming. The erosion experiment worked perfectly, even as the one in Berkeley. It demonstrated to the crowds that jammed one end of the building the menace of erosion. I was interested to see the faces of elderly men, educated men, light up as the significance dawned upon them.

There was a fine exhibit featuring 2905 wheat, a variety developed by the division of agronomy in cooperation with Cornell University and the General Education Board of the Rockefeller Foundation. This wheat has proved to be high in proteins, to make up into better bread, and to yield considerably better than local varieties. It has become very popular and now, after 5 years, is being grown over most of the Province. Methods of control of insects and diseases were also shown. Another exhibit pertained to disease-free silk worm eggs and improvements in sericulture.

In the big gymnasium, all was given over to citrus improvement. This exhibit would match an exhibit of our United States Department of Agriculture. The size of fruit would not equal that of California oranges and tangerines, but the flavor does. Every phase of production, of prevention of disease, of harvesting and transportation was in the exhibit, and the grand finale was a pyramid of oranges. These exhibits brought out the benefits of research.

There were exhibits of tobacco growing, and of corn and potatoes, all products of the new world which have been taken over by the Chinese. Entomology exhibits showed interesting things in insect control. For example, there is the discovery of a fungus that wipes out bedbugs in a few hours. Now it is proposed to spray spores of this fungus in proper places as a measure of control. Formerly, Japan produced most of the pyrethrum, a sort of chrysanthemum that produces an insecticide, but now China is taking steps to produce its own supply.

It seems almost a miracle that the University of Nanking School of Agriculture and Forestry has been able to move, to keep its staff together, its spirit alive, and to increase its enrollment. Everywhere I find

Nanking graduates doing important things. I find that one of my best introductions in China is that I was once on the faculty of Nanking University. It is the agricultural fields which have made Nanking prominent. This reflects great credit on Joseph Bailey, John Reisner and Dr. Bowen, to have set going an institution of such fine caliber.

I was invited to the home of the Governor of Szechuan in celebration of the signing of treaties between China, Britain, and the United States. There were about 250 guests, including 50 foreigners. On the wall of the great hall were pictures of the Generalissimo, Roosevelt, and Churchill, and the flags of the three countries. The governor made a splendid talk to which there were responses from an American and a Britisher. A group of Chinese sang "America the Beautiful." In the evening we witnessed a colorful parade of lanterns and lighted dragons and figures, accompanied by firecrackers. The parade ended with a big bonfire around which the students gathered by the hundreds, sang songs and cheered.

Doubtless wartime conditions in the United States have made travel conditions more difficult, but in China they are next to impossible. Formerly one chose the date for starting a trip, but the traveler in China today is not the one who decides when he is to set out. Planes from Chungking to Chengtu are few and uncertain. We waited days for one and finally, after more delay, we obtained reservations on the most reliable means of travel—the postal truck. It is filled with mail bags and the maximum of passengers who have paid in advance for passage. Then the driver gets for himself all extra fares. We were packed in with sardine compression, each clinging to some valuable parcel. The weather was cold but the "human heaters" kept us from freezing. At first I was in the front seat, but after getting out to stretch my aching bones, I found a woman and a baby in my seat, so I took my turn to be jolted around on the mail bags.

On my second trip between Chungking and Chengtu there were 30 of us in a big transport plane, stripped of all comforts and without seats—just flat floor like that of a freight car. Baggage was arranged along the edges and we sat down as best we could.

West China weather is similar to Washington, D. C.—very hot in summer and cold in winter. It seems colder here in the winter however, for there is no heat in any of the buildings, and I both eat and sleep in all my clothes. The sun never shines then because the great cloud bank piles up against the high mountains of Tibet. We looked forward to sunny days, but when they came, I realized they were a sword of Damocles hanging over us.

Shortly after my arrival, while I was at the em-



The head of a great gully which has cut up the valley in this rich loess region of windblown soils in northwestern China similar to the Palouse country of the United States. Giant fingers reach far back into the good earth on either side of the gully, drawing away moisture as well as soil.



The author hoeing corn with a foot-bound woman refugee from the famine region of Honan. He is showing the way to make basins to hold the rain.



A threshing floor in northwestern China. Notice the humps on the skyline. They are not haystacks, but huge tombs, each covering several acres of rich land for 3,200 years. Those ancients had plenty of land to set aside, but in this fertile and populous region outside Sian the loss of many acres of fertile land is a great tragedy.

bassy, an air raid alarm sounded. Two balls went up on signal posts telling that Jap planes were in Szechuan and were expected to reach Chungking within half an hour. People were soon on their way to bomb shelters without unusual noise or excitement. Some were on foot, some in sedan chairs or rickshaws, women with boxes or bundles of valuables. Others were hastily catching chickens and ducks, cackling and squawking, to put inside their houses while they were in the shelters. When I smiled in passing, I got cheerful responses. I was interested in the spirit and attitude of the people as they prepared to receive the deadly "iron eggs" of the Japs. People gathered around the openings of dugouts in the sides of hills. There was no hysteria, only grimness. Chungking has built so many shelters in the rock foundations on which it is built that the entire population can scurry to its holes in short order.

But a new day has come for Chungking at long last. American planes and fliers have arrived and the Japs are acquiring a wholesome respect for them. Before the Japs reached Chungking, our fliers were at them furiously and not one Jap plane reached the city.

The Chinese Government has been exceedingly cooperative and for our long trip of 5 months traveling northward, we were provided with a large station wagon with truck wheels which enabled us to go over difficult roads. It was large enough for the driver and myself and eight highly trained Chinese, each representing a different phase of agriculture. Each keeps notes from his particular viewpoint and we shall write a bulletin with joint authorship when we return. When we wished to discuss any area, we had a classroom in the auto.

The first outstanding experience of the trip was my visit to the engineering works at Juan Hsien, constructed by Li Bing and his son Er Wang 2,250 years ago. Their work has unfailingly provided irrigation waters and food for the vast Chengtu Plain, where is maintained the most dense farmland population in the world. Here 6 million Chinese support themselves on less than 500,000 acres, or an average of more than 2,000 to each square mile of soil.

To think of Li Bing is to realize the centuries of stability, intelligence, and genius of our Chinese ally. Before our ancestors had emerged from the forests of northern Europe, wearing wild animal skins, Li Bing had an intelligent understanding of hydraulics and engineering, and had caught the waters of the Min River as they tumble out of the Snow Mountains of Tibet. He cut away the side of a mountain to divert water and interlaced the main channels with canals so that teeming millions for 22 centuries have never

suffered a famine or a real flood. He did this as governor of Szechuan Province in the Ching Dynasty, at the very beginning of the long period known as the Golden Age of China. Today these works still provide one of the cheapest irrigation supplies to be found anywhere in the world.

I was impressed with the simplicity of Li Bing's plan, which was completed by his son Er Wang. It has been just this simplicity which has kept it in operation these many centuries. Li Bing is the first engineer I know of whose problem was providing for streambed load or debris, and who had the ingenuity to solve it. He utilized excavation and the simplest and least costly materials—wood, bamboo, and stones picked out of the stream bed, which he built into uncemented but well designed structures to divert water as he chose. Then he prescribed a maintenance system on tablets of stone and built a temple to place it on a religious basis. These provisions have safeguarded the project for more than 2,250 years and would doubtless keep it in operation for another 20 centuries if modern engineers were not eager to utilize the wasted power possibilities and provide increased irrigation by a dam and water storage.

Several intensely interesting days were spent at the annual "opening of the irrigation canals" which was attended by some 40,000 Chinese.

Wherever I have traveled in the steep hill lands and even up the gorge of the Min River, I have found bad examples of land-use and of farmers tilling fields which range up to 100 percent slopes. I posed this question to my staff, "How are we to get these farmers to give up cultivation on steep slopes?" One of the men who had studied in Germany, wanted the Government to lay down strict laws and force the farmers to comply. Such a plan, I observed, could not last long. I tried to get him and the others to see that the only reason that we are interested in conserving land is because we are interested in conserving human resources; that when a farmer on these slopes gets only a fourth as much grain as the farmer in the plain for the same amount of work, we have a waste of such resources. I proposed the hypothesis that China really had her Golden Age back in the years when fewer farmers tilled more land and that this gave rise to more division of labor; that as sizes of farms were reduced by population pressure in a purely agricultural society, the division of labor decreased and brought on a decline in standards of living. The right use of land is our key problem and its solution will go a long way toward solving other problems.

We passed through the salt regions of West China. Afterward we stopped at Jadin to see the giant bud-

dah, carved out of massive red sandstone at the junction of two rivers. The figure is 200 feet in height and the head is 30 feet across. No one seemed to know just how many centuries it had stood there.

We started out from Chingtu on the old road over which Marco Polo must have traveled, but it has been widened into an auto road. The country is varied and beautiful. We passed through a gorge where there is a magnificent dam site, not unlike that of Boulder Dam. Often 50 percent of the slope area with its brown soil had just been planted to corn. The slopes appeared to be tipped up by some giant to spill out the soil, crop and all. At another place the river flowed through a natural tunnel through rock so that all that would be necessary to make a dam would be to plug the tunnel opening. On every slope telltale benching had grown over, showing abandoned fields, whereas other benches constituted cultivated fields up to 2,000 feet above the river.

I am spending most of my time in the northwest, because slope cultivation is the big problem of this area. It is a distinct misuse of land and of manpower that farms it. Buck's survey shows that a farmer must work three to four times as hard and as long to produce the same amount of grain as does the farmer in the lowlands where fields are irrigated.

Whenever possible, we stayed with missionaries. That gave us a touch of the homeland. But where available, we also have found China's Travel Service hotels quite satisfactory. In the loess region, we frequently slept in caves. They are cooler in summer and warmer in winter, and are really very comfortable. I have seen some of the most remarkable country, some of the most spectacular scenery—river gorges and mountain peaks through whose passes we traveled at elevations of from 6,000 to 12,000 feet.

While being delayed by rain at Shan Shi Pu, which is the headquarters of the industrial cooperatives, I looked into the cooperatives with great interest. One, a machinist cooperative of 56 members, has a plant powered by an undershot waterwheel run by a mill race of only 3 feet effective head. It develops about 12 horsepower. This waterwheel turns the lathes, the iron planers, drills, and stamp machines. Here machines are made for other cooperatives. Members are paid according to their skills, and at the end of the year each receives a dividend based on his earning powers. This gives incentive to improve skill and workmanship. Nearby were woolen and cotton spinning cooperatives. Wherever we stop, officials invite us to tea to discuss their land problems.

We went out to see the demonstration area for gully control which had been selected. Here we found enormous gullies cutting down through slopes 1,000

feet from divide to streambottom. Half the land was cut up, destroyed for farming. My staff seemed subdued. I laid down some fundamentals, and said that we must have action and a definite program. This gully-riddled landscape has a fascination for me. It was in such country that the idea struck me so forcefully 20 years ago that soil erosion could undermine a civilization if not controlled. Now I am back to test the soundness of our judgment in attacking the problem. I believe we can treat these loess lands to absorb all the rain that falls. We can also introduce tree crops on a large scale on our demonstration area—walnuts, persimmons, jujube, and apricots, along our bench terracing banks, and hardy willow, and elms in gully bottoms, to build up and increase the fuel supply so badly needed here.

First, we classified the land for uses best suited for prolonged safety. Then we designed and applied measures of water conservation to each land class—for farm cultivation, for grazing, and for farm wood-

lots. Judging from what a few farmers have done here and there, I feel we have a program that will work.

I sit for hours pondering the panorama of these landscapes of fascinating diversity of terraces, long broken down or in the process of breaking, and riddled with these huge gullies which have had a head start by several centuries on our gullies in the Piedmont or in the southwest. It is a tragic struggle between the farmer and unabsorbed rain waters. If we can absorb all the rain in these porous liess soils and do it far enough back of banks to avoid forming sinkholes, we shall have done four important things: (1) Increased crop production, (2) controlled erosion, (3) reduced flood flow, and (4) minimized the silt load of the streams. If we can do all this out here where the situation is more serious than it is in the United States, where China has the manpower, then the experiences will be of inestimable value in the control of our own great gullies.

MANAGING THE WATER FROM THE "ROOF TOP" OF THE NATION

By C. J. FRANCIS

THE WESTERN PART of the Northern Great Plains region—Montana and Wyoming—might be called the "roof top" of the Nation, because it is crossed by the Continental Divide and the several ranges of the Rocky Mountains.

This vast area produces good stands of timber, furnishes summer grazing for livestock and most important of all, is favored by heavy snowfall. Most of the water used for irrigation in the 17 Western States originates there. The many streams rising in that mountainous country flow into three major drainage basins—the Mississippi, the Colorado and the Columbia. The Missouri River, a tributary of

the Mississippi River, is formed by the confluence of the Jefferson, Gallatin, and Madison Rivers which head in southwestern Montana. The Green River rises just south of Yellowstone Park and flows south to the Colorado River. The Snake River rises in Yellowstone Park and flows southwest out of Wyoming into Idaho on its way to the Columbia River, while another great tributary of the Columbia, the Clark Fork River, rises in western Montana and is

EDITOR'S NOTE.—The author is chief, regional engineering division, Soil Conservation Service, Lincoln, Nebr.

Drainage puts nonproductive land back into production.





Removal of willows at a cost of \$7 to \$9 per acre boosts production from nothing to 60 bushels of oats per acre.

fed by several large tributaries in Montana during its northwesterly course.

Water flowing from the "roof top" of the Nation must be carefully conserved and wisely used to insure that lands depending on irrigation can take their rightful place in providing the necessary production increases imposed by war.

As might be expected, irrigation has been practiced in the western part of the Northern Great Plains region almost from the time of its settlement. Because of the control that can be exercised over irrigation water, it is possible to increase production on a majority of the crops as much as 40 percent over the production obtained under haphazard irrigation methods. Both the district supervisors and the Soil Conservation Service recognize this fact and have emphasized the application of conservation practices relating to the handling of water on irrigated lands.

At present, there are 4 million acres under irrigation in the region, approximately 906,105 acres of which are contained in 41 active soil conservation districts. New districts are being formed and extensive additions are constantly being made to those already established. Farmers and ranchers are quick to see the progress that can be made in solving irrigation and drainage problems through the group approach which is one of the basic precepts of soil conservation district organization. They realize that improvements made to irrigation systems provide maximum production which, in turn, creates a larger net return.

The problems involved in giving assistance to district supervisors in connection with the handling of irrigated lands vary widely. Some of the irrigation systems serve only one farm or ranch, others serve hundreds. The lands range from high mountain

meadows devoted to hay production only, to lower valley lands where feed and row crops predominate and farming is intensive.

Among the major jobs confronting Soil Conservation Service technicians assisting soil conservation districts are the rehabilitation and construction of irrigation systems on individual farm units, including redesign of ditch systems and building control structures; cleaning and leveling land; acquainting farmers and ranchers with the use and application of water; development of cropping systems balanced with land capability; repair and reconstruction of existing over-all supply systems; planning and building supply systems to bring new land under irrigation, and drainage of seeped land. One of the most important phases of the work consists of the technical help given farmers in handling of the water and land on individual farms. D. A. Williams, irrigation engineer of the Pacific Region, explained this work in his article in the July issue of the Soil Conservation magazine.

A large portion of the work accomplished in this region is applied to individual farms and is handled by the operators themselves through technical service given by the Soil Conservation Service and equipment placed at their disposal by the district supervisors. However, in order for water to be made available to the individual farm unit, it is necessary that a reliable and adequate source of supply be made available. The distribution works of many irrigation systems in the region have fallen into a state of disrepair, making it impossible for farmers to provide the increased food production they seek. The action program of conservation districts affords the best means of handling individual and group problems pertinent to irrigated lands. The acquisition of



This flume made it possible to place 533 acres of land under irrigation.

equipment on a group basis and the provision of technical services to the community make possible the solution of the individual and group problems at reasonable costs.

The Northern Great Plains region has accomplished a great deal in assisting irrigation farmers and the scope of the work is increasing rapidly. The cost in most instances has been borne wholly by the individual or groups benefited. Shortly after the start of the year the Service allocated funds for special drainage and irrigation projects of a demonstration nature. The purpose was to undertake community type projects rapidly and give special assistance to groups of farmers in order to increase food production. The major accomplishments include the cleaning of existing canals to restore their capacity, repairing wash-outs in supply canals, rebuilding or repairing flume and siphons, lining ditches, clearing land not now in production, and leveling land to provide for efficient irrigation.

Perhaps best illustrative of the effects of clearing land is the work done in the Star Valley Soil Con-



Leveling land permits utilization of efficient irrigation methods and provides uniform distribution of water, resulting in increased crop production.

servation District at Afton, Wyo. Here the district supervisors have been loaned a D-7 tractor and carry-all scraper by the Soil Conservation Service. About 12,000 acres of the valley's best land is willow-covered and unproductive. From the start of the irrigation season on through the construction season, the tractor equipped with a special bulldozer blade designed by technicians of the Soil Conservation Service is used to clear the willow-covered lands. The cost runs \$7 to \$9 per acre, and the average yield of the land the first year after clearing is 60 bushels of oats per acre. It is estimated that one unit will clear 1,000 acres per year. From the time of the spring break-up until the water is turned into the main canals in May, the tractor and scraper are used to clean the canals of silt and willows to provide the capacity needed. This has made it possible to irrigate properly, and crop production has increased greatly. Costs are borne wholly by the district co-operators using the equipment.

The Popo Agie Soil Conservation District, Lander, Wyo., utilized a tractor loaned them by the Service on ditch cleaning. As this equipment could not meet the requirements of the landowners, a contractor was brought in to speed up construction. One big canal was rehabilitated, involving the movement of 11,100 cubic yards of earth. The job cost \$1,301 and benefited 22 farmers. The farmers spent \$950 and the Soil Conservation Service, through the district supervisors, contributed \$351. A total of 1,800 acres of land was benefited, and the estimated increase in production for 1943 is 28,000 bushels of grain, 1,400 tons of hay, 2,400 animal units of pasture.

Another job in the same area involved the cleaning of a ditch system and replacement of a metal flume 240 feet long. Working through the district supervisors, the Soil Conservation Service agreed to stand

(Continued on page 142)

STUBBLE MULCH in the SOUTHERN PIEDMONT



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On the grain lands of the Pacific Northwest and of the Great Plains stubble mulch farming has found wide acceptance. Few recent agricultural innovations have traveled so far or so fast. Crop residues used as stubble mulch are effectively fighting wind damage on hundreds of thousands of acres in the "blow" States, and at the same time are conserving moisture, improving soil structure, and checking run-off. The practice is solidly entrenched in the West as a standard soil-management measure.

Now, when every effort is being brought to bear to increase farm production for war needs, comes this suggestive article from the great research center at Watkinsville, Ga. From this we may gather that in the Southern Piedmont, too, the stubble mulch idea is collecting adherents. Research has gone far enough indeed to indicate trends that warrant serious consideration by progressive Southern farmers. THE EDITOR.

By B. H. HENDRICKSON, JOHN R. CARREKER,
WILLIAM E. ADAMS

THE UTILIZATION OF STUBBLE mulches and crop residues involves such factors as the kinds and quantities of residue materials produced, the tools available for the required tillage, and the seed-bed requirements of the succeeding crops.

Small grains and most hay crops leave light to crops harvested for seed leave moderate to heavy moderate amounts of residue on the fields. Legume residues, depending largely on stand densities and volumes of stem and leaf growth left on the ground or scattered out when combine-harvested. The legume stubble mulches are richer in nitrogen, and thus more valuable than the nonlegume stubble mulches. Those derived from close-growing types of legumes are more effective for erosion control and for fertilizing. Regardless of harvesting method, most annual farm crops, excepting peanuts, leave roots in the soil to die and decay, whereas perennials persist and gradually develop massive root systems. The more extensive the root systems, the more valuable they are for soil improvement and conservation purposes.

Residues and stubble mulches are available in late spring from winter annuals, and in the fall from summer crops. Tools for stubble land preparation in the Southeastern Piedmont include principally turn plows, disk-tillers, rippers and scooter-plows, and harrows of various types.

EDITOR'S NOTE.—The authors are project supervisor, associate agricultural engineer, and associate agronomist, Soil Conservation Service, Watkinsville, Georgia.

THE PICTURES

1. Volunteer crop of Korean lespedeza seed on a field double-cropped to rye and lespedeza.
2. Harvesting Kobe lespedeza hay.
3. Potato-digger point used for ripping of lespedeza stubble mulch as preparation for following row crops.
4. Two-inch-wide scooter point with braced heel-sweep mounted on a Haimon plowstock—a satisfactory tool for stubble mulch land preparation. It leaves residues on the surface.
5. Tractor-drawn 4-prong ripper satisfactory for spring preparation of lespedeza stubble mulch land for summer row crops.
6. Tractor planting of soybeans in rows on ripped lespedeza stubble mulch land.

Some of the questions regarding tillage of stubble mulches are whether to turn them under, whether to turn them in and only partially cover them, or whether to loosen the soil by shallow ripping so as to leave them practically intact on the surface. In certain crop successions, no tillage at all seems best. Leaching of nitrogenous materials in surface residues due to weathering, and the nature of the decomposition complexes, with special reference to the evolution of nitrates from various residues, are subjects on which more information is needed.

Wheat-straw mulch applied by hand in 1940 to an 11-percent slope run-off plot 70 feet long, which had been disk-harrowed and sown to Kobe lespedeza, showed astonishing ability to reduce erosion to a negligible quantity and to maintain the highest infiltration. The action of the close-growing summer annual, Kobe lespedeza, combined with the mulch, unquestionably enhanced its effectiveness. Starting in April 1940, this plot lost only 1.2 percent of the rainfall as run-off for the remainder of the year, and only 0.24 ton per acre of soil. A companion plot, similarly handled, but without the applied mulch treatment, lost 24.2 percent run-off and 12.62 tons per acre of soil, during the same period.

The value of continued self-mulching has been shown by the subsequent performance of these two plots, since both of them have remained in pure stands for repeated seed production, leaving the full combine-harvest stubble mulches on the land. Soil and water losses have continued to be very low. They have, in fact, shown by far the best conservation record to date of any method under test on the Station run-off plots, despite the severe erodibility of the site they occupy. In addition, seed production of 282 pounds per acre in 1942 on these two wasteland plots equaled or exceeded the seed yields obtained on the best of the cropland fields.

Hand-applied straw mulching is hardly practical under farm conditions except for small critical areas. The results do show that practically complete control of soil and water loss was obtained even on steep slopes with the topsoil entirely washed away. Under the considerably less erodible conditions of average cropland fields, every approach to this ideal condition that is possible in any practical

cropping system holds high promise of being effective.

A heavy stubble mulch such as that developed by well-established kudzu with only reasonable quantities of hay removed, has provided almost perfect erosion protection and greatly reduced run-off losses. Kudzu residues plowed under have greatly stimulated corn yields on poor land unsuited to corn production by ordinary cropping methods.

The harvesting of all plant growth including roots, as in the case of harvesting peanuts for both nuts and hay, is a serious soil-depleting practice.

On the other hand, when only the seeds of legumes are combine-harvested, there is left on the field nearly all of the plant materials, including leaves, stems, and roots. These residues are relatively rich in nutrient value and have both soil-protective and fertilizing value.

The proper handling of legume residues to utilize the nitrogen released during decomposition is especially important during wartime. The decomposition of soft green plant tissue is rapid when plowed under as green manure in the presence of warmth and moisture which favor the activities of soil fungi and bacteria. Opposite conditions are represented by hard, woody, dead plant residues lying on top of the ground during dry cold weather.

The rapid release of nitrates following the turning under of a summer legume green manuring crop, or of the later green growth following hay cuttings, suggests that fall-planted crops should quickly succeed them in order to utilize the nitrates and prevent them from being lost by leaching.

Lespedeza-stem mulch, as distinguished from the complete leaf and stem residues, has some apparent fertilizing value for the following summer crop. This was shown in Station tests in which the stem-mulch material of second year volunteer Kobe lespedeza seed crop residue was raked off duplicate plots in the fall of 1941, and left in place on adjacent plots. The third-year volunteer lespedeza hay crop that followed was 11 percent larger where it had been subjected to the full effect of residue. In August, when the hay was cut, the stem residues of the last year's crop had virtually all weathered down and disappeared.

Another instance lending support to the belief that lespedeza stem mulch has fertilizing value was shown by applied mulch tests begun in the early spring of 1940 on eroded land sown to Kobe lespedeza. During the first growing season, waste cowpea hay which had already started to rot when applied as a surface mulch stimulated the highest lespedeza hay yield. During the second season, in 1941, the plots in which

lespedeza straw, or stem mulch, had been originally applied produced the greatest volunteer hay crop. The plots mulched with cowpea hay were in second place, and the wheat straw and pine straw mulched plots next in order.

Wheat has been grown for several years on large fields as a starting crop following weedland or ordinary row-cropping field conditions, and as a second annual, or double crop, in lespedeza fields. When both crops have been combine-harvested in turn, the lespedeza has almost always succeeded as a dense volunteer stand. In the fall of 1940 three fields were seeded to wheat, and several comparable fields were available for comparison in which wheat had been preceded by 2 or 3 years of lespedeza under a stubble-mulching practice. The latter fields produced up to 100 percent higher wheat yields in 1941.

Following three years of the wheat-lespedeza sequence, utilizing all residues for protection and soil improvement, corn in 1941 produced 39.3 and hegari 48.6 bushels per acre as compared with approximately 20 bushels per acre from the same class of land the same season in the usual cotton-corn-cowpea cropping practices.

Cotton, following an early spring turn-under of Korean lespedeza stubble mulch, required no nitrate of soda side dressing to produce the highest cotton yield grown on the station fields in 1941. Corn failed to respond to any additional nitrate side dressings under similar conditions in both good and poor corn growing seasons. In a 3-year stand of kudzu, in which strips were plowed out for corn and large quantities of kudzu stubble mulch turned under, the corn yielded well and did not respond to nitrate side dressings. There is little question that legume stubble mulches are capable of supplying substantial amounts of soil nitrogen for the use of the succeeding crops.

Hegari stubble mulch, probably the heaviest produced during the combine harvest of any grain crops, was removed from parts of two fields, and left in place on the balance of the fields. None of the following winter crops of barley, crimson clover, nor of the subsequent summer crops of lespedeza and soybeans was affected perceptibly in stand or yield. The non-legume mulch materials did not produce in the soil any appreciable effect tending to increase crop yields.

These results bear out the contention that practical conservation management of erodible croplands should favor cropping plans that provide for accumulations of legumè residues to be left on the land.

The leaf residue remaining on the land in good stands of sericea, regardless of whether hay or seed

crops, or both, were harvested, has for the past 2 years supplied excellent starting conditions for new overplantings of crimson clover in the fall. This winter clover is often difficult to grow under ordinary cropland conditions. When over-planted in sericea, clover helped to check erosion during the winter and early spring periods, and the combination stand produced a heavy May cutting of very palatable hay.

Crimson clover has succeeded well when sown in soybean and cowpea combine stubble mulch. On the other hand, crimson clover sown in non-legume corn and hegari stubble mulch land in the same field started out well and then died out in one winter. Apparently, nitrates produced by leaching and rapid decomposition of leaf residues of soybeans, cowpeas, sericea and kudzu stimulated crimson clover seedlings sufficiently so that they were more vigorous and better able to resist the effects of fall drouths and early freezes.

Present indications are that a very important application of stubble mulch utilization methods applies to the annual lespedezas and the handling of their residues in row crop rotation for the multiple purpose of obtaining decreased runoff, better erosion resistance, and increased soil productivity. Our data is based largely on 4 years' experience in handling the annual lespedezas in various cropping practices on several hundred acres of typical Southern Piedmont cropland in both row crop rotations and as self-maintained pure stands.

For cropland uses, to obtain the most benefit from the lespedezas there seem to be at least five good rules: (1) make initial plantings in small grain; (2) plant at considerably heavier seeding rates than are generally recommended, never less than 40 and preferably 60 pounds per acre to obtain a full seed crop and as heavy residues as possible the first year; (3) allow at least 2 years' growth of lespedeza to obtain maximum after-effects; (4) cut lespedeza hay early, not later than early-bloom stage if subsequent fall growth before frost is expected to produce a good amount of residue material; if harvested for seed instead of for hay, the maximum amount of residue

material will be developed—preferably, the first-year stand is harvested for seed, since this practice practically assures a thick volunteer stand the following year for hay; and (5) turn under the second-year stubble mulch during the winter or in early spring, as the weather permits, to allow for partial decomposition of the residue and settling of the seedbed.

Legumes can help to obtain more efficient use of cropland (1) by developing permanent pastures of grass and clover sod on bottom land, (2) by making possible upland temporary pastures for a succession of small grain and lespedeza or (3) by establishing themselves in sericea, kudzu, or other crops suited for pasturage. Livestock may then pasture off the bulk of the feed they require on as nearly a year-round schedule as possible, thus reducing the need for feeding legume hay and permitting more residues to remain on the fields. Most Southern farms are not adequately equipped to harvest efficiently and store large quantities of hay, yet livestock enterprises are expanding. Handling crops in this manner, the smart farmer can obtain an occasional manuring of some of his temporarily pastured cropland fields and secure added land protection and soil improvement.

On average croplands, if lespedeza, cowpeas, or soybeans are the summer legume crops, and winter cover crops are to follow, the hay-crop stubbles may be turned or disk-tilled and oats drilled in September in order to give oats the early start that it needs for best winter survival. Winter legumes usually would be expected to succeed best as a following crop if sown in the disked hay stubble and covered lightly. After a fall seed crop of lespedeza, soybeans, or cowpeas is combine-harvested, a planting of wheat or winter barley is generally preferable, drilled on a disk-tilled seedbed with the heavier stubble mulch only partially turned under. In the case of Kobe lespedeza, combine-harvested for seed in November, there appears to be little object in following with winter legumes planted so late, since the stubble mulch of lespedeza is known to supply good winter protection and cold weather checks decomposition of surface residues. Experience has shown that turning under of this stubble mulch can proceed at any time weather permits during the winter and early spring months land is being prepared for summer crops. without inviting undue soil loss by erosion while the



Farmers in the L'aigle Creek Soil Conservation District, Arkansas, have recently invested \$6,000 in the construction of more than two dozen ponds for the production of bass and bream, two palatable species of warm water fishes.



SOIL CONSERVATION

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MANAGING WATER FROM "ROOF TOP" OF NATION

(Continued from page 137)

the cost of rebuilding the flume. As metal was not available and a temporary shortage of lumber existed, the flume was replaced by an earth fill. A total of 4,800 cubic yards of earth was placed in the fill and 9,240 cubic yards of earth was removed from the canal. The Soil Conservation Service contributed \$1,950, representing the cost of the earth fill built through contract, and the district expended \$1,120 in ditch cleaning operations. Eight farmers were benefited by the construction. If the flume had not been replaced, these farmers would have had to rely on rainfall, which is insufficient in this area to supply crop requirements. The estimated total increase in production resulting from the work is 10,500 bushels of grain, 700 tons of hay, and 1,360 animal units of pasture.

Another example—

The Cook Ditch Association operating within the Lawrence-Butte Soil Conservation District having headquarters at Spearfish, S. Dak., was faced with the loss of irrigation water for 533 acres of land through the failure of a wooden flume. The ditch system connecting with the flume was in need of cleaning to provide the flow required by the land under the ditch. The labor for building the flume was supplied by the farmers themselves, and equipment was loaned to the district for cleaning the ditches. The Soil Conservation Service contributed \$131 while the Cook Ditch Association expended \$405 to bring the work to completion. Crop production on the 523 acres of land benefited was increased by 96 tons of alfalfa, 200 tons of corn, 1,710 bushels of barley, and 3,100 bushels of potatoes.

The Lawrence-Butte District has a 75-horsepower tractor and carry-all scraper on loan which is used exclusively in heavy leveling operations. There is a large acreage of land in the district requiring extensive leveling if water is to be properly applied. The cost of this work varies from \$8 to \$15 per acre, depending on the volume of earth that must be moved. There is enough work of this type to keep the equipment busy for several years. All of this type of work

is completely paid for by the farmers themselves. This district also has a $\frac{3}{8}$ -yard combination dragline and shovel which was used throughout the construction season in building drainage ditches. There is a large area of seeped land which is susceptible to drainage at reasonable cost. The construction of adequate drainage systems will put land back into production and greatly increase the crop productive capacity of the district. The rental rate charged by the supervisors is \$5.50 per hour, the total expense of which is borne by the cooperator.

These examples serve to show the assistance Service technicians are able to give soil conservation districts in this region. Each district has one or more pieces of heavy equipment that is used continuously during the construction season on projects of this sort. Except for the projects cited, and a small number of similar projects, the entire expense is borne by the farmers and ranchers. Complete records for this year's operations are not yet available but when they are compiled, soil conservation districts in this region will show enormous food increases which can be directly traced to conservation practices applied to the land. Water is the controlling factor in crop production in this region. The policy in the Service is to give its use and control proper consideration in the development of every farm plan.

At the annual meeting of the Audubon Society in New York City, October 19, Dr. H. H. Bennett, Chief, Soil Conservation Service, stressed the importance of soil conservation as an aid to wildlife. Said Dr. Bennett, "Soil conservation farming will double the number of the common birds of the farm. We know this because it has already been done on hundreds of farms throughout the country. When all the farms of the Nation are properly treated for the conservation of soil and water, one result will be a 100-percent increase in bird life. And as a result there will also be, of course, an enormously greater protection of crops from the ravages of insect life."

For REFERENCE

Compiled by **ETTA G. ROGERS**, Publications Unit



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Symbolic of good practices is this winter-blanketed New England farmstead. Wooded are the hillsides, to slow the snows for gradual release to thirsty soils. Full are cribs and silos and lofts. Well fed and productive are the bovines of the barns. Buildings reflect the prosperity wrought by proper husbandry of the land. Here is an instrument potent in war and in peace. Any American loving the good loam, and loving the good life of the free, would be proud to call this "home." (Photograph by courtesy of Farm Security Administration.)